

371.42
H 18

THE HIGHER INDUSTRIAL EDUCATION.

By Prof. JOHN HAMILTON, of the Pennsylvania State College.

Read before the Pa. State Board of Agriculture

This is a nation of workers. Almost every industry, from the most simple and easily understood, to the most complex and difficult, is pursued among us. In the earlier stages of society, when wants were simple, the forms of labor necessary to supply these wants were correspondingly simple; but as the race progressed and tastes became more highly developed, the demand for the old simple forms was lessened, and new and higher and more complex forms were required.

This progress has continued until the necessity for ordinary labor has become comparatively slight, and the number of common workers, as instanced by the army of the idle, is greater than the demand, whilst the demand for skilled workers is constantly increasing, and the number responding is far below what is required. Every year seems to have added to the ranks of the unskillful, and consequently unemployed, until the subject of their relief has become a grave national question. Labor, too, has become alarmed at her situation, for she has discovered that if she would not be left to gain her livelihood in abandoned processes and unremunerative forms, she must do one of two things, either stop human progress, or else keep pace with civilization. Although the first proposition is advocated by some as the remedy for what they term the wrongs of labor, yet it is so opposed to the spirit of our institutions as to be unworthy of serious consideration. But the second question is one of very grave importance. What can be done to enable labor to keep abreast of civilization, and in time lead its advance? For many years labor has been asking this question. For many years the most able philanthropists and statesmen have given it their careful attention, and the more thoroughly it is investigated, and the longer it is considered, the more decided, emphatic, and unvarying is the reply that is returned: educate labor and along with labor the laborer.

The great need of the industrial classes in order to meet the demands of the times is knowledge, a knowledge of what to do and how to do it. They, in other words, need education, and such education as will best fit them for their pursuit in life.

This idea has, in an informal way, been handed over to the educators of this country, with the request that they provide a course in education that will meet this want.

For more than twenty years the question has been before the educational institutions of this and other States, and whilst progress in the direction of industrial education has been made, yet most have to confess that existing plans are immature and present methods are far from perfect.

For quite a while the leading educators and educational institutions of this country either totally ignored the project or treated it with contempt. But the demands of the people for some system of relief became so urgent

that they were forced to drop their old educational prejudices and set themselves to meet these new demands. And now the course of educational thought seems to be in the direction of making education a more available means of advancing the interests of industrial art.

Those who are engaged in industrial pursuits may be divided into two classes: First, "Those who work under directions, or day laborers. Second, Those who direct and control, who invent new processes or improve the old. "The first embraces the trades and requires long practice in order to skillful performance." The second calls for, first of all, a thorough acquaintance with the principles underlying the art; and second, such practical acquaintance with it as will enable the individual to perceive its demands.

In order that the wants of these two classes may be met, there ought to be, it would seem, two kinds of industrial education provided, one for the trades, and one for the higher forms of industrial art. It is practically impossible for the mass of workers ever to pursue any very extended course of education, or in other words, become college graduates. Most are too poor to spare either the time or the money for such a purpose. Many are disinclined to study. And multitudes see no necessity for such extensive knowledge in order to gain a livelihood. Comparatively few, therefore, of the whole number of workers will obtain diplomas from the colleges of the land. Most must be content with the education given in the common schools, whilst many are destitute of even that. The art education of these multitudes, who are thus deprived of collegiate advantages, is a subject all important and requiring immediate attention on the part of legislators and educators; and upon its proper solution will depend in a large degree the progress of industry and the welfare of the country. The character of the subject assigned me, and the limits of this paper, forbid my discussing this division of industrial education. And I shall do no more than express the conviction that it is not only possible, but entirely practicable for a considerable degree of art education to be given these masses, and that, too, without serious additional expense to the State.

The subject that I am called upon to consider is, "*The Higher Industrial Education*," or such education as will fit men for higher industrial life.

For years many of the most thoughtful and intelligent men of the land, in looking into the educational system of their time, felt that something important was lacking in the course of training pursued by classical schools. Whilst these schools sent out men of large learning and great mental ability, for the learned men of that day, and modern times have produced none greater, were almost, without exception, trained in these schools, and, although they received young men from every situation in society, from all occupations, professions, and trades, yet they returned but a small percentage to industrial pursuits; but gave, on the contrary, their classes nearly unbroken to professional or literary life, thus causing the brains of industry to be appropriated by professional pursuits. The results of this course of training had become so certain that the fact that a boy from industrial life was in college, and intended to graduate, was positive evidence that that boy was lost to industrial art.

There was something in their course of education and training that gave a boy a distaste for industrial pursuits, and as certainly gave him a longing for professional or literary life.

This could have but one effect upon the industries of the country, and that was to seriously retard their progress, and eventually cause their death. In view of the serious consequences sure to come when this pro-

ductive strength of the country is taken and turned into unproductive pursuits, leaving only the ignorant to do manual work, it became exceedingly important to the prosperity of the country to discover some means for arresting this flow. So alarming did this injury to industrial pursuits become, that the national Legislature was called upon to provide a remedy.

Congress, after very full discussion of the problem, and after consultation with men of all classes, learned and unlearned, ideal and practical, both in this country and in foreign lands, passed the act of July 2, 1862, entitled, "An act donating land to the several States and Territories which may provide colleges for the benefit of agriculture and the mechanic arts." It, of course, became important to know just what kind of a school Congress intended to establish. The act declares that "the leading object should be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the Legislature of the State may prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life."

Congress thus intended to establish schools that would "promote the liberal and practical education of the industrial classes in the several pursuits and professions in life," mentioning specially agriculture, the mechanic arts, and military tactics. Or, in other words, a school which shall better fit men for industrial pursuits, in order that thereby they may benefit industrial arts. Congress clearly did not intend to establish the old classical schools, or schools to turn out men for the so-called learned professions or literary life. These already existed, and it was to cut loose from these and the course of training so destructive to industrial art that it gave the lands. Congress wished to establish a school, not for the literary classes, but for the industrial classes. It would therefore seem, under this act, to be a perversion of the funds granted to use them for the purpose of giving a purely classical education, since this appears to be the very thing Congress ought to avoid. A purely classical educational course, therefore, in such a college ought not to be maintained, or if maintained at all, not out of this fund.

The act declares not only that schools shall be established for the benefit of the industrial classes, but it also says that the education given must be "liberal and practical." It lays no more stress upon one than upon the other. It does not say that it shall be two thirds liberal and one third practical, or the reverse, or that one man shall be educated liberally and another practically, but it is to be liberal, and at the same practical. There seems to be no limit to the extent of this education further than that fixed by circumstances and the demands of the times, but it must, nevertheless, be kept in mind, that however short or extended the course may be, the liberal and practical education must go hand in hand, and no sacrifice of one for the benefit of the other is allowed. Neither is it first liberal and then practical, but liberal and practical side by side.

"The primary object of education is the discipline and improvement of the mind." A man's power for usefulness, other things being equal, "depends upon his mental power, and his value to the world depends upon this and his ability to use that power for the good of his race." An idiot or an imbecile is of little use as a member of society, or as a citizen of the State; but a Webster or a Clay makes his influence felt throughout the world. It has been well said that "it is to the mind of man chiefly that must look for the gauge of his power," and the effort therefore of a college should be to develop this power in the highest degree." If he is to be

useful he must have this mental force. It is the main power of the man; deprive him of this, and he is not only utterly useless, but a burden to society. But if the mental development is all that is needed, why not, you ask, turn the pupil over to the classical schools, which profess and confessedly do give this training? Just here is the difficulty with the literary colleges. The course of study by the old system devoted the entire time of the student to literary work. To languages, literature, philosophy, pure mathematics, &c., and the whole atmosphere of the college, the conversation, dress, and habits were such as to draw away the tastes from industrial pursuits to professional life. Their failure as industrial educators was not in the too great development of the minds of their pupils, but in influencing these minds to forsake industrial life. Here is the key to the whole question of higher industrial education. The old methods of instruction were defective in that they gave the students' mind a bias towards literature and the professions instead of toward useful industrial arts. The industrial education must remedy this not by giving inferior training, but by biassing the mind towards industrial art. The object of an industrial college should therefore be to first of all educate mens' minds, educate them highly, not give them less power than do the literary schools but a greater, and then turn these minds thus trained and educated, into not literary, but industrial pursuits. This accomplished, the problem of industrial education is solved.

But what is meant by "industrial pursuits?" Does it mean that men shall be educated highly, until they possess great mental power, and then devote the rest of their lives to breaking stones upon a turnpike, or to digging ditches, at fifty cents per day? Does it mean that such a one shall, if his tastes are mechanical instead of agricultural, simply clean grease from old castings, or sledge up old iron during his entire life? It does not. The man is capable of doing better work than this and it would be a prostitution of his powers for him to devote his life to any such employment. The demand in industrial life is not so much for "day laborers as for improved processes." "There are day laborers enough, but what is wanted is better and more economical methods." Manual skill in the art is not so much needed as knowledge of the principles that control the art. Not so much a man to follow a plow, as a man that will invent a plow that will do twice the work with half the cost of the present one. It would be great folly for a man of high attainments to devote his life to labor that would bring him but fifty cents per day, when he could as easily earn twenty-five dollars in the same time, by pursuing a different course. "Common labor is, and always will be, cheap," and it is useless to expect that men will go to college, spending from one to two thousand dollars, besides years of labor, in the acquirement of an education, in order that they may devote their lives to digging ditches. A college education is not necessary in order that a man may be a good ditcher. The man can earn no more at this business, with his education, than without it; possibly not as much as the uneducated man by his side. Muscle is needed here, and muscle is paid. An educated man cannot hold plow enough better than the uneducated man to justify the employer in giving him seven or eight times the wages of the other, and so in mechanical trades. Here is the rock upon which so many plans for higher industrial education have split. They expected men to spend thousands of dollars in the acquirement of a thorough education, and then go to work at common labor for fifty cents per day. Their pupils did not do it, and they never will do it. Their duty to themselves, to their families, and to society, demand that they do better, if they can. It may be accepted as a principle in life that men work for money, and not

for pleasure alone, and that an "industry must be remunerative, or it will lack competent men."

"The graduates of these colleges must get lucrative employment in industrial art, or they will leave it."

The place for the man possessed of higher industrial education is not that of a hewer of wood or a drawer of water, but in the higher departments of industrial life. There is where the demand is made.

A cry comes up to these schools for competent directors, inventors, improvers, investigators, superintendents, engineers, discoverers, managers, designers, and the like. Comes up from all the departments of industrial art, and these will furnish ample and remunerative employment for men of education, through all time to come.

It is evident, too, that these schools are not schools whose object it is to teach trades, "for it is impossible in the limited time of a college course to do justice to the mental culture of the student, and at the same time give a high degree of manual dexterity in any trade." So much and such sort of practice can and should be given, as is needed to illustrate and enforce instruction in the principles of the art, and no more.

Trade schools on the other hand, and for similar reasons, can do little else than teach the trade.

The true object of these higher industrial schools is to send out classes of highly educated men and women, who, instead of turning their attention to the professions or literature, will direct their powers towards the improvement of industrial art, and benefit the body of workers through the discovery of principles, and the improvement of processes in all the departments of industrial life.

The object is to educate men who, with, their superior mental power and knowledge of science and art, will devote their lives to inventing, managing, organizing, directing, and discovery. Men of high scientific attainments who shall reveal to the mass of mankind the practical uses of science. Men like Franklin, Johnston, Watt, Leibig, and others taking one or several branches of industrial art, and improve it and make it available to the mass of their fellow-men, discovering new and improved methods that the most ignorant can apply in their daily work.

Here is the work of the higher industrial schools, and the field is limitless. Agriculture, mechanics, science, architecture, fine arts, manufactures of every conceivable kind, and in every land call for talent and ability to devote their powers to their use, and they pay for it—pay far better than the learned professions, as law, medicine, or literature.

Here is a field unoccupied by the educational institutions of the day. The literary colleges do not fill it, but, on the contrary, drain it of its present life. Let the literary colleges still supply the ranks of literature and the professions;

Let the industrial schools see that equal power is yearly added to the ranks of industrial life.

The important question yet remains, can a system of education be constructed that will certainly and surely graduate men of high attainments into industrial life?

I believe that it can. I believe that it is possible and practicable by a proper system of training, to turn men into any pursuit in life. History shows that this has been done, and observation of existing institutions shows that it is done to-day. The principle is no new one, neither is it uncertain in its action. It is old as history, and as certain as any other law. The universal practice of individuals in the government of their families, of all bodies, civil and religious, in dealing with mankind, prove

conclusively that training,¹ habit, and association are the "forces that mould the race." The children of Catholics are commonly Catholics, those of Presbyterians, Presbyterians; the children of Democrats, Democrats, those of Republicans, Republicans; and the same law and principle holds true throughout the whole structure of society. The reason why the children of lawyers are not always lawyers, and those of other professions and trades the same as that of their fathers, is because no judicious course or special training for this purpose was brought to bear upon the child in its early life. When children are devoted to the ministry by their parents at an early age, they commonly adopt this life, and the same is true of the law and other professions. Children wander off into other trades and professions, because they are left largely to themselves, or see but the disagreeable side of their father's work.

The Jesuits train ninety-nine in one hundred of the boys that they get to be Jesuits; and they do it by system, there is no chance about it. West Point turns out her soldiers year after year, and she manufactures them from the raw material. Princeton, Yale, and Harvard each turn out men of different stamp. Oxford, Cambridge, and the various German universities, each sends out its distinctive class of thinkers.

The influences they bring to bear mould the minds of those whose education they control. What system of education then will cause students to choose industrial rather than literary life? This is the educational problem that has occupied the attention of the friends of industrial education for many years. I have stated that the old methods of instruction were defective as industrial educators, in that they gave the minds of their students a bias towards literature and the professions instead of toward the useful arts. Their course of study, their methods of instruction, the tastes of their teachers, and all the influences of the educational establishment were calculated to magnify literature and the learned professions, and breed a contempt for practical life in the mind of the student.

The teachers were commonly men whose education was of the literary kind, knowing but little of the wants of practical life, or the necessities of useful art; on the other hand, they rather prided themselves upon their abstractions, and despised the knowledge that attempted to reduce these to such forms as might enable them to be used by the world beneath them. Is it strange that from such teaching and such associations young men, in their ignorance of the real want and opportunities of practical life, should turn to learning and abstraction instead of to useful arts? Is it not rather strange that ever one returned to practical pursuits; when, as, in rare instances, it did occur, that some one appreciating the demand of the vast field of industry upon educated men, resolved to enter it and contribute his share for the benefit of his race, his purpose was met by the pitying smile of teachers, and perhaps the open sneer of his cultivated classmates. For years the scientific students in Yale and Harvard were despised by the literary classes, and to-day the literary colleges, though not so much as formerly, look with contempt on the scientific schools, and even in these scientific schools themselves the practice of useful industry in connection with collegiate training is sneered at as unbecoming and unfit employment for gentlemen of brains.

I will not be understood as undervaluing literary studies. On the contrary, I believe that no education can be complete without somewhat of this literary culture. But what I do protest against just here, is the intellectual snobbery that assumes that useful art is necessarily degrading. The means that I have to propose for turning the tide of higher education into industrial channels, is to have the circumstances in these schools in

accord with the object to be attained. Give a discipline and education of such a kind and in such a way, and under such circumstances, as will bias the mind of students in the direction of industrial art. How can this be done? I reply that it cannot be done, if the men who lead in industrial education do not believe in it. To put a Democratic President with a democratic cabinet into power, to carry out Republican principles, would be thought absurd. To put a Quaker, no matter how able or how good a man he might be, at the head of our armies, would not be considered good policy, especially if the government was engaged in an extensive war. To make a Presbyterian Pope of Rome, would not be the best way to propagate the doctrine of papal infallibility throughout the world. The principle that is involved is, that those who give direction must be in sympathy with the main idea of the project. So it is in industrial colleges, there must be first of all, and before anything else is done, a corps of instructors informed as to the wants of industrial life, and in full sympathy with industrial education. The lack of this, more than the defect in the system of education pursued, has caused the failure of so many of our industrial schools.

I reply, second, that the system of education and course of study must be different from that of the old classical schools.

I do not mean that the industrial course should cut itself loose entirely from the old education of the classical schools. These schools did good work in developing the mind, and so far as they trained the intellect and developed mental power were all right, and the studies that tend to this development should still be kept and required, not, perhaps, to the extent that they required, but to some extent, and to an extent sufficient to make correct thinkers and strong reasoners.

But the old education neglected to recognize the fact that life deals not only with mind and metaphysics, but with matter as well, and, consequently, those subjects of study that give information in material things were omitted, or, in other words, the natural sciences were not taught as studies bearing directly upon the practical side of life. Nature was left to take care of herself, and man's relation to natural things was not shown. Their graduates were expected to understand logic, rhetoric, mathematics, and language; but botany, geology, chemistry, and the other sciences that affect practical life were not required, or, if required, were superficially taught. The industrial education should make much of these natural sciences, partly because they are matters necessary in any well rounded education, but chiefly because of their bearing directly upon the practical side of life, and because of their tendency to give that bias to the minds of students that it is the object of an industrial education to give.

These sciences should not be taught in their abstract form alone, but in a practical way, keeping constantly before the mind of the pupil the economic value of the sciences that he studies, and the relations that exist between these sciences and practical life, and at the same time their influence upon the comfort and happiness of mankind should be fully and clearly set forth.

The higher industrial education means not an inferior education, but one more extended than that of the old, for it is evident that the man who intends to make the domain of nature and art his life study, should, in order to interrogate intelligently, and interpret the replies correctly, have an education superior to one who wishes merely to gain a livelihood in law or medicine, or professional life. He must first of all take rank as an educated, competent man. He must meet the classical scholar upon his

favorite ground, and must stand side by side with the eminent scientists of the day. He must, in other words, combine the acquirements of both.

But it is not enough in an industrial education that a man have merely a knowledge of the theory of things. A man may know the theory of music and not be able to strike correctly a single note. A man may understand the theory of swimming, and yet, when plunged into the water, go to the bottom like a stone. Knowing, without ability to do, is of little value. Power of any kind, without ability to use it, is about worthless; and ability to use comes only through practice. It is well established that it takes "practice to make perfect." There must be practice in all education. Chemistry, botany, mathematics, literature, language, and art each requires practice to fix the student's knowledge, to familiarize him with the details of processes, and to give him confidence in his ability to do.

Whilst this is important in any education, it is specially important in industrial education in giving that bias that it is the special aim of these colleges to give. The practice should be adapted to the course of study, and it, like the rest of the educational course, should be a complete and progressive course, and not the repetition of previous practice, but new work at each successive stage of progress. No student should be exempt. If he is physically unable to practice, he will be unable to pursue an industrial calling, and should therefore go to some school where the object is not specially to produce scholars for industrial life. The amount of this practice should be simply enough to fix the student's knowledge, and no more. He is not here to learn a trade either in science or art, he is here for his education, and if he wishes to pursue a special course in any department of study or practice, he can do so in a post-graduate course. For it is evident that if he does so whilst in his regular course, he must do it at the expense of some other branch of learning, and no one department has a right to rob another of reasonable facilities for culture. As constituting a most important part of the industrial practice, I mention drawing in its various departments. It is the alphabet of art, and it gives a familiarity with the forms of things, and keeps the student to the practical side of life as nothing else that I know of does. It is all important in a course of practice in an industrial college.

This, then, is, in general terms, the way that I propose for causing students to enter industrial life. Add to the old education: First, teachers familiar with the wants of and in sympathy with industrial art. Secondly, a full and thorough scientific course, with, at least, one modern language. Thirdly, a progressive, well arranged and equipped, system of practice. I do not mean by this three separate and distinct courses of study, a classical, scientific, and practical. I would have but one course combining all these, and required of all students who enter. Not a classical school, not a scientific school, not a trade school, but a combination of all these—an industrial school.

In the course of studies that I am about to submit, it has been the aim, not only to meet the views advanced in this paper, but also to construct a course arranged so that any section of it will be complete, that whether the student wishes to stop early or late in his course, he shall have had symmetrical development, and a complete education so far as he has gone, and no matter what his pursuits in after life may be, to fit him in the best possible way for engaging in it with the highest credit and profit to himself, and, at the same time, enable him to elevate his calling among the industries of the world. It will be noticed that the course submitted provides no optional studies.

If the college is to bring about definite results the means must be used

and insisted upon that will bring about those results, and whilst only those studies, and so much only of them as is necessary to the end in view, should be permitted in the course, yet these should be required. These studies have been prescribed because they are deemed necessary, and not merely to fill up the curriculum. Students who are up in the course may take extra studies, but not as substitutes for those prescribed. In cases where students have not the time to complete the entire course, and wish to enter upon their specialty, they may be permitted to stop in their college course after the sophomore year, and pursue a special study, giving the entire time to this study until it has been completed. The object of the college being, however, to induce students to take the full course, and then pursue one of the post graduate courses to fit them for their special work.

The college course contemplates topical study and recitation, and in order that this may be most efficient and practical, each professor should make out a complete schedule of hours of recitations in a given study in his department. The days upon which his recitations shall come; the number of pages for each day, and in addition should make out a list of reference for each topic, showing where the latest and most reliable information can be obtained in regard to that topic. Said list to be printed in the text book, so as to be easy of access by the student. The library of the college should become a reference library, and those books referred to by the professors should be purchased and placed on the shelves for use by the student.

The course of study submitted contemplates recitation upon five days of the week, leaving Saturday for recreation and society work. The schedule for each day gives eight hours for sleep, eight hours for study and recitation, and eight hours for meals, recreation, drill, and practicum, and is arranged as follows:

		Hours.		
Sleep,	10 — 6	8		
Breakfast,	6 — 7	. . .	1	
Study,	7 — 9	. . . . .		2
Recitation,	9 — 12	. . . . .		3
Dinner,	12 — 1.30	. . . . .	1.30	
Practicum,	1.30 — 3.30	. . . . .	2	
Dress for drill,	3.30 — 4	. . . . .	.30	
Drill,	4 — 5	. . . . .	1	
Supper,	5 — 7	. . . . .	2	
Study,	7 — 10	. . . . .		3
		8	8	8

Academic Course—Three Years.

Hours per week.	FIRST YEAR.	Hours per week.	SECOND YEAR—Continued.
4	Elementary Algebra.	1	Tactics.
1	Descriptive Astronomy.	4	Drill for Boys.
3	Latin.	4	Calisthenics for Girls.
1	Physical Geography.	10	Practicum, { 5. Horticulture and Gardening.
1	History and Constitution of U. S.		4. Drawing.
1	Botany.		1. Music.
1	Moral Philosophy.	1	Rhetoricals.
1	English Literature.	THIRD YEAR.	
1	Agriculture.	2	Geometry.
1	Tactics.	1	Plane Trigonometry.
4	Drill for Boys.	2	Latin.
4	Calisthenics for Girls.	2	Greek.
10	Practicum, { 5 Agriculture.	2	French or German.
	4 Drawing.	1	Agriculture.
	1 Music.	2	Chemistry.
1	Rhetoricals.	1	General History.
SECOND YEAR.		1	Mental Philosophy.
3	Higher Algebra.	1	English Literature—Shakspeare.
1	Geometry.	4	Drill for Boys.
2	Latin.	4	Calisthenics for Girls.
3	Greek.	10	Practicum, { 5. Mechanics.
1	General History,		4. Drawing.
1	Agriculture.		1. Music.
1	Natural Philosophy.	1	Rhetoricals.
1	English Literature.		
1	Physiology.		

College Course—Four Years.

Hours per week.	FIRST YEAR.	Hours per week.	SECOND YEAR.
1	Surveying.	1	Spherical Trigonometry.
2	Analytical Geometry,	2	Calculus.
2	Chemistry.	2	Zoölogy.
1	Botany.	2	Latin.
1	Anatomy and Physiology.	2	Greek.
2	Latin.	2	French or German.
2	Greek.	1	History of Literature.
2	French or German.	1	Civil and Common Law.
1	General History.	1	Rhetoric.
1	Agriculture and Mechanic Art.	1	Agriculture and Mechanic Art.
4	Drill and Military Science, (boys.)	4	Drill and Military Science, (boys.)
4	Calisthenics and Domestic Science, (girls.)	4	Calisthenics and Domestic Science, (girls.)
1	Rhetoricals.	1	Rhetoricals.
10	Practicum, { 1. Surveying.	10	Practicum, { 4. Chemistry.
	2. Botany.		1. Zoölogy.
	4. Drawing.		2. Drawing.
	1. Music.		1. Music.
	2. Agriculture.		2. Mechanics.

Hours per week.	THIRD YEAR.	Hours per week.	FOURTH YEAR.
2	Civil Engineering.	1	Astronomy.
2	Mechanics and Mechanical Engineering.	1	Ethnology.
2	Geology.	2	Physics.
2	Physics.	2	Constitutional History and International Law.
2	Greek.	1	Philosophy of Science.
1	Evidences of Christianity and Elements of Philosophy.	1	Comparative Philology.
1	History of Arts and Manufactures.	2	History of Philosophy.
1	Logic.	2	Natural Theology and Philosophy of Religion.
1	Political Economy.	3	The Great Masters in Art compared.
1	Agriculture and Mechanic Art.	4	Drill and Military Science, (boys.)
4	Drill and Military Science, (boys.)	4	Calisthenics and Domestic Science, (girls.)
4	Calisthenics and Domestic Science, (girls.)	1	Rhetoricals.
1	Rhetorical.	10	Practicum, { 5. Drawing. 1. Music. 4. Mechanical Physics.
10	Practicum, { 4. Drawing. 1. Geology. 1. Music. 4. Mechanics.		

Post Graduate Course.

School of general and applied chemistry.

School of civil and topographical engineering.

School of mining and metallurgy.

School of agriculture, horticulture, and landscape gardening.

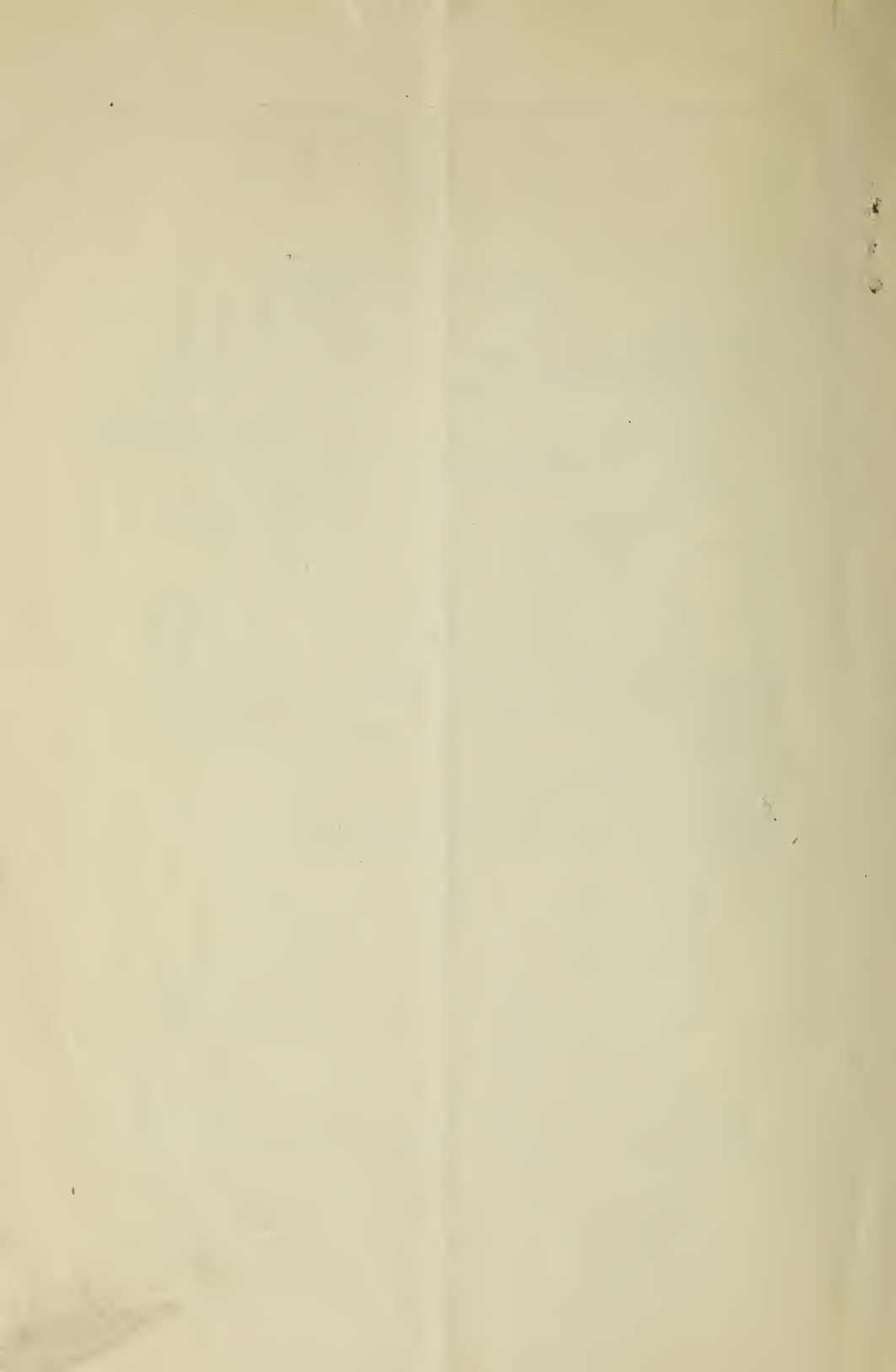
School of design.

School of commerce and trade.

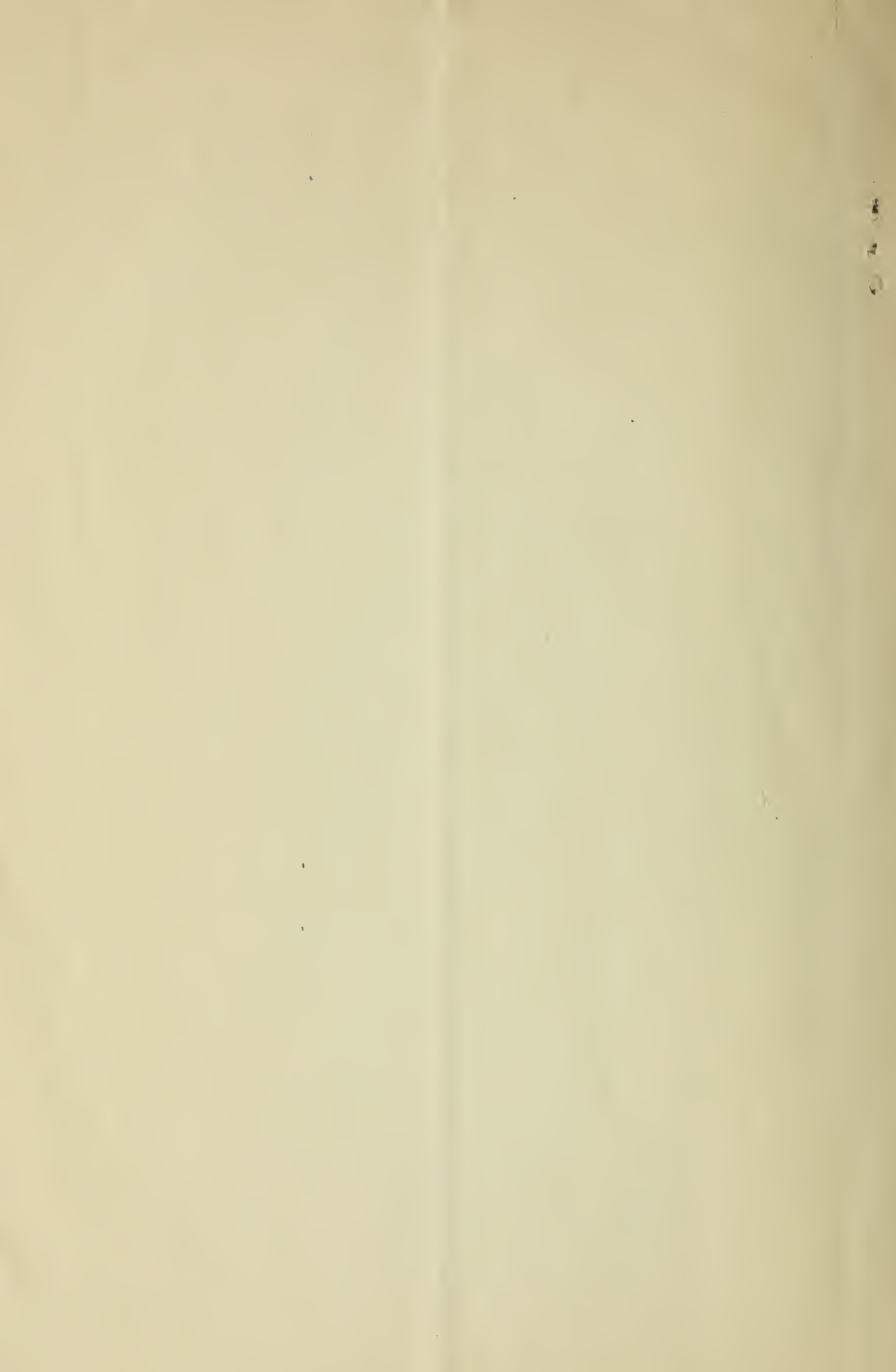
School of fine arts.

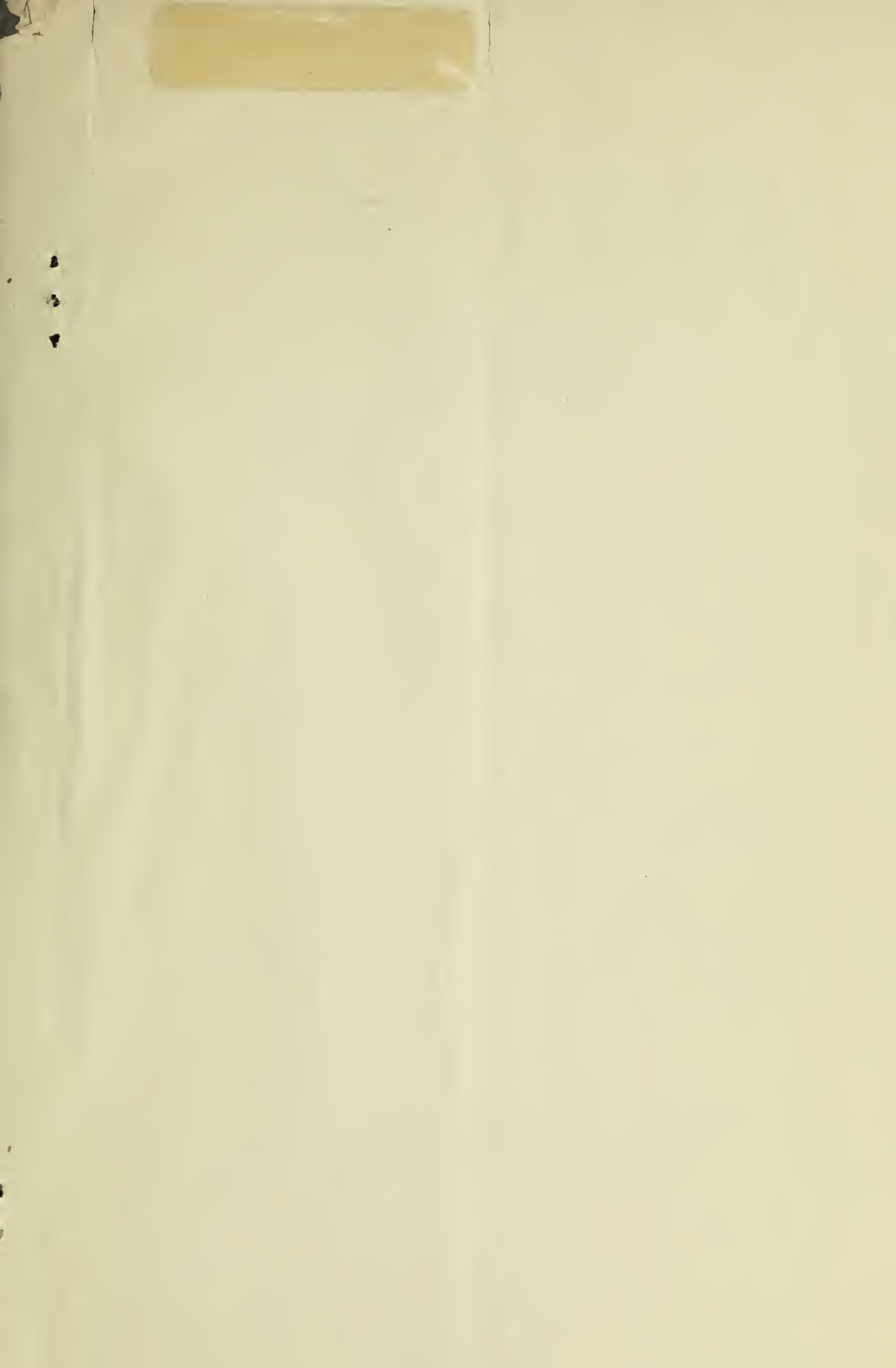
School of building and architecture.

School of mechanics and mechanical engineering.











3 0112 062169583